CLAIMS

What is claimed is:

1. An apparatus for detecting the surface topography of a cornea of an eye, comprising:

   (a) a first light source for dynamically or statically projecting a light pattern onto a first surface area of the cornea;

   (b) a first detector for detecting the light pattern as reflected by the first surface area of said cornea;

   (c) a second light source for illuminating a component of said eye disposed beneath said cornea through a second surface area of the cornea with a second light; and

   (d) a second detector for detecting the second light as reflected back from said component of said eye beneath said cornea,

   wherein said second surface area comprises a central portion of the cornea surface, and wherein said first surface area surrounds said central portion of said cornea surface.

2. The apparatus according to claim 1, wherein said second light source comprises means for dynamically or statically projecting a light pattern onto said component of the eye beneath the surface of said cornea.

3. The apparatus according to claim 1, comprising at least one laser light source.

4. The apparatus according to claim 1, wherein the first light source comprises a Placido Topometer, wherein the Placido Topometer is positioned in such a way that the second light from the second light source is guided through the beam path of the Placido Topometer to the eye, and that the second light as reflected back from said component of the said eye beneath the cornea is guided through the beam path of the Placido Topometer to the second detector.

5. The apparatus according to claim 1, wherein the second detector determines the wave front profile of said second light.

6. The apparatus according to claim 1, further comprising means for deflecting the second light and guiding said second light into the eye at different points of a plane.

7. The apparatus according to claim 6, wherein the means for deflecting and guiding the second light comprises at least one swivelable mirror.

8. An apparatus for detecting the surface topography of a cornea of an eye, comprising:
   (a) a first means for dynamically or statically projecting a light pattern onto a first surface area of the cornea, and
   (b) a second means for detecting the light pattern as reflected by said first surface area of the cornea;
   (c) a third means for determining at least one optical property of a component of the eye disposed beneath the cornea, based on reference measurement of an impinging light that is directed into the eye.

9. The apparatus according to claim 8, wherein the third means measures said impinging light before its entry into the eye, directs said impinging light to illuminate said component of the eye beneath the cornea through a second surface area of the cornea, and then measures the impinging light as reflected by said component of the eye beneath the cornea.

10. The apparatus according to claim 8, wherein said third means comprising a beam splitter for splitting the impinging light into at least two portions, and wherein a first portion of the impinging light is used for reference measurement.

11. The apparatus according to claim 10, wherein said beam splitter comprises a prism splitter.

12. The apparatus according to claim 10, whereby said third means further comprises at least one reference mirror for guiding said first portion of the impinging light for measurement.

13. The apparatus according to claim 8, comprising at least one laser light source.

14. The apparatus according to claim 9, wherein the first means comprises a Placido Topometer, which is positioned in such a way that the impinging light is guided through the beam path

of the Placido Topometer to the eye, and that the impinging light as reflected back from said component of the said eye beneath the cornea is guided through the beam path of the Placido Topometer to be detected.

15. The apparatus according to claim 9, wherein the third means determines the wave front profile of said impinging light.

16. The apparatus according to claim 9, wherein the third means further deflects the impinging light and guides said impinging light into the eye at different points of a plane.

17. The apparatus according to claim 16, wherein the means for deflecting and guiding the impinging light comprises at least one swivelable mirror.

18. A method for detecting the surface topography of a cornea of the eye, comprising the steps of:

(a) dynamically and statically projecting a light pattern onto a first surface area of the cornea;

(b) detecting the light pattern as reflected by said first surface area of the cornea;

(c) illuminating a component of said eye disposed beneath said cornea through a second surface area of the cornea with an impinging light; and

(d) detecting the impinging light as reflected back from said component of the eye beneath the cornea,

wherein the second surface area comprises a central portion of the cornea surface, and wherein the first surface area surrounds said central portion of the cornea surface.

19. The method according to claim 18, further comprising the step of dynamically or statically projecting a light pattern beneath the cornea surface.

20. The method according to claim 18, further comprising the steps of evaluating wave front of the reflected impinging light, and determining the overall distribution of refractive power of the eye with local encoding based on the evaluation.

21. The method according to claim 18, further comprising the steps of determining one or more properties of the eye based on the detected data, wherein said properties include: size of the cornea surface, size of posterior surface of the cornea, size of anterior surface of the lens, size of posterior surface of the lens, size of surface of the retina, radius of curvature, refractive power, and absolute height value of the cornea.

22. The method according to claim 18, wherein information on the optical boundary surfaces of the refractive apparatus of the eye is determined along an optical axis from the pupillary aperture up to the retina.

23. The method according to claim 18, wherein the impinging light is focused on a focal point in the eye, wherein said focal point is moved along the optical axis extending from the cornea to the retina, and wherein reflection maxima are determined along said optical axis.

24. The method according to claim 18, wherein the impinging light is focused on a focal point in the eye, wherein said focal point is moved in a plane perpendicular to the optical axis extending from the cornea to the retina, and wherein the reflection of the impinging light is measured at different points in this plane.

25. A method for detecting the surface topography of a cornea of an eye, comprising the steps of:

(a) dynamically or statically projecting a light pattern onto a first surface area of the cornea;

(b) detecting the pattern reflected by said first surface area of the cornea;

(c) providing an impinging light;

(d) measuring said impinging light before its entry into the eye;

(e) directing said impinging light to illuminate said component of the eye beneath the cornea through a second surface area of the cornea;

(f) measuring the impinging light as reflected by said component of the eye beneath the cornea; and

(g) determining at least one optical property of said component beneath the cornea, based on measurements of the impinging light.

26. The method according to claim 25, wherein an impinging light of known beam profile and/or wave front is impinged into the zone of a pupillary aperture of the eye, and then and directed onto the cornea and the lower sections of the eye.

27. The method according to claim 25, comprising the steps of determining and comparing the wave front profile of said impinging light before its entry into the eye and the wave front profile of said impinging light as reflected by the eye.

28. The method according to claim 27, wherein the wave front profile of the impinging light before its entry into the eye is determined by splitting the impinging light into at least two portions, guiding a first portion of said impinging light directly or indirectly onto a detector, and guiding a second portion of said impinging light into the eye.

29. The method according to claim 27, wherein the overall distribution of refractive power of the eye is determined with local encoding by evaluating the wave front profile of the impinging light as reflected by the eye.

30. The method according to claim 25, comprising the step of determining one or more properties of the eye includeing: size of the cornea surface, size of posterior surface of the cornea, size of anterior surface of the lens, size of posterior surface of the lens, size of surface of the retina, radius of curvature, refractive power, and absolute height value of the cornea.

31. The method according to claim 25, wherein information on the optical boundary surfaces of the refractive apparatus of the eye is determined along an optical axis from the pupillary aperture up to the retina.

32. The method according to claim 25, wherein the impinging light is focused on a focal point in the eye, wherein said focal point is moved along the optical axis extending from the cornea to the retina, and wherein reflection maxima are determined along said optical axis.

33. The method according to claim 25, wherein the impinging light is focused on a focal point in the eye, wherein the focal point is moved in a plane perpendicular to the optical axis

extending from the cornea to the retina, and wherein the reflection of the second light introduced into the eye is measured at different points in this plane.

34. An apparatus for detecting the surface topography of a cornea of an eye, comprising:

(a) a first light source for dynamically or statically projecting a first light of a known pattern onto a first surface area of the cornea;

(b) a second light source for illuminating a component of said eye disposed beneath said cornea through a second surface area of the cornea with a second light; and

(c) at least one detector for detecting the first light and the second light as reflected back by the eye,

wherein said second surface area comprises a central portion of the cornea surface, and wherein said first surface area surrounds said central portion of said cornea surface.

35. The apparatus according to claim 34, wherein said at least one detector detects the second light before its entry into the eye, and wherein at least one optical property of said component of the eye beneath the cornea is determined based on detection of the second light before its entry into the eye and as reflected by the eye.

36. The apparatus according to claim 35, wherein said at least one detector determines the wave front profiles of the second light before its entry into the eye and as reflected by the eye.

37. The apparatus according to claim 34, comprising a single detector for detecting the first light and the second light as reflected back by the eye.

38. The apparatus according to claim 34, comprising a first detector for detecting the first light as reflected, and a second detector for detecting the second light as reflected.

39. The apparatus according to claim 38, wherein said second detector detects the second light before its entry into the eye, and wherein at least one optical property of said component of the eye beneath the cornea is determined based on detection of the second light before its entry into the eye and as reflected by the eye.

40. The apparatus according to claim 3, wherein said at least one detector determines the wave front profiles of the second light before its entry into the eye and as reflected by the eye.